Reynolds' financial figures for year-end 1991 confirm their currents problems with US tobacco sales. Total sales of $14.99 billion showed an 8% increase as compared to year-end 1990, while operating income increased by 4% to $2.93 billion. Net sales for tobacco were $8.54 billion, a 6% increase as compared to 1990. The fraction of sales deriving from US operations was 72% of the total as compared to 28% for international sales. However, international sales increased by 19% as compared to 1% for domestic sales. The same comparison with respect to operating profits is even more striking, in that international operating income increased by 21% compared to a 4% decrease in domestic operating income.

With respect to net income, Reynolds showed a profit in 1991 of $368 million, as compared to a loss of $429 million in 1990. This was Reynolds' first profit since the KKR takeover; that is, the first year the operating income has exceeded interest expenses on the long term debt. As a consequence of the massive debt resulting from the leveraged buy-out, Reynolds' number one priority for some time has been cost reduction in order to pay down debt as quickly as possible. One result of these measures was the closing down of some unprofitable plants and the reallocation of production of certain cigarette brands. For example, Reynolds' Belgian factory at Gosset was closed, and production was transferred to Reynolds Germany. Currently, Reynolds has only four manufacturing sites in Europe - two in Germany, Trier and Berlin, one in the Canary Islands, and one in Dagmersellen, Switzerland. Of these four, the Trier factory is probably the largest. The Trier plant produces approximately 80 brands of cigarettes from 100 different blends in some 530 pack variations. These are exported to 90 different countries. The Trier factory has developed a flexible approach with regard to primary processing, manufacture and packaging, and has its own offset printing works. Apart from high speed machinery, there are also older units which produce small batch sizes more economically than the faster models. The result of the strategy of concentrating European production in Germany is that in the past five years Reynolds Germany has increased its exports by about 20 billion units.

(b) Major Products and New Product Activity

Reynolds' market share in the six major Western European countries is fairly constant except for the Netherlands, where it is significantly above the average share, and Italy, where it is significantly below. Actual market shares are, the Netherlands, 15.1%; Spain, 8.2%; France, 8.1%; Germany, 6.6%; Belgium, 5.6%; and Italy, 2.1%. Reynolds is essentially a one brand company in Western Europe, and that brand is Camel. Market shares of Camel by country are the Netherlands, 14.7%; Spain, 1.8%; France, 7.2%; Germany, 5.2%; Belgium, 2.7%; and Italy, 2.0%. Only in Spain, where Winston has a 6.4% market share, and Belgium, where St. Michel has a 2.5% market share, does Reynolds have significant market share for other brands. Market share, year-to-date, for Camel has declined significantly in Germany (16.1%), France (8.9%), and Spain (18.2%). On the other hand, Camel's market share has increased both in Belgium (17.4%) and the Netherlands (4.2%). Market share in Italy has remained about constant. It is difficult to find an explanation for this type of bi-modal behavior. Winston market share has declined precipitously in Spain (21.0%), and St. Michel in Belgium has also shown a significant decline (13.8%).

Since July 1, 1991, Reynolds has introduced five new products into Western Europe, one in France, one in Belgium, and three in Germany. Camel KS Box 25s was introduced into the Belgian market in December, 1991, and has year-to-date sales of 125 million units, while Camel Ultra Mild KS Box was introduced into France in September, 1991, and has year-to-date sales of 145 million. None of the three products introduced into Germany, Club KS Box 10s, September, 1991, Monte Carlo 100s Soft 25s, February, 1992, and Club Menthol KS

Box, August, 1992, have achieved significant sales. Total new product sales for Reynolds, year-to-date, are 300 million units.

(c) Technology Assessment

Reynolds' investment in R&D is significantly greater than all other tobacco companies except for Philip Morris and Japan Tobacco. However, essentially all of their R&D is located in Winston-Salem. They have a small laboratory in Cologne, headed by Mr. Barton, staffed by 25 individuals. This lab carries out QA and some Product and Process Development. The Winston-Salem facility has a staff of about 650 scientists and technicians. In addition to the normal work on product and process development, Reynolds is particularly strong with respect to ETS research and biochemical research. In addition, they have an excellent analytical chemistry department. Reynolds continues to maintain a high level of patent activity. In the nine month period from July 1, 1991, to March 1, 1992, they had 39 US patents issued to them along with 5 EPO publications. About half of these patents are focused on two specific areas; namely, non-conventional smoking articles and low sidestream cigarettes and/or papers. In the smoking article group, the following patents are of potential interest. US 5,042,509 describes a method for making an aerosol cartridge. US 5,052,413 discloses methodology for assembling a non-conventional smoking article and its components. US 5,088,507 teaches an apparatus for assembly of the aerosol generating component. US 5,038,802, a continuation of a 1988 patent, discloses a method for obtaining flavor substances for Premier type smoking articles. Lastly, both US 5,060,669 and US 5,074,319 teach processes for obtaining flavorful tobacco extracts for smoking articles.

In the low sidestream area, some of the patents of interest teach the addition of various types of inorganic fillers to cigarette papers. Two patents, US 5,050,622 and US 5,085,232, both employ varying percentages of both magnesium hydroxide and calcium carbonate in the wrapper. In addition, the wrapper contains a water soluble alkali metal salt. These patents claim cigarettes with low sidestream, improved taste, and improved ash characteristics. US 5,056,537, which teaches the use of expanded tobacco, reconstituted tobacco with calcium carbonate, and a non-woven polypropylene web filter, claims low levels of visible sidestream smoke. Other patents claiming low sidestream are: US 5,060,673, which utilizes tobacco extract, pyrolyzed alpha-cellulose, and agglomerated calcium carbonate particles; US 5,060,675, which uses a paper with calcium carbonate and a coating containing magnesium hydroxide; US 5,074,321, which teaches the use of pyrolyzed alpha-cellulose in conjunction with a low porosity wrapper; US 5,092,353, which utilizes the addition of 60% calcium carbonate to the filler in conjunction with a low porosity wrapper; and EP 458,526, which recites a dual wrapper.

Reynolds continues to receive patents for expansion related processes. Recent issues include US 5,095,922, which claims a G-13 type process using carbon dioxide as an expansion agent, and US 5,065,774, which teaches a process for expanding tobacco using moderate conditions. Other patents assigned to Reynolds of interest include: US 5,074,320, which teaches a paper filter containing magnesium hydroxide; US 5,050,090, a computer based object placement method; US 5,092,349, which discloses a quality control method which uses machine lubricants doped with trace amounts of flavorants in order to determine the source of spots on cigarettes; and finally, US 5,099,862, a tobacco extraction process which contains a fermentation step for producing a pack aroma enhancer. The complete list of Reynolds patents arranged by subject is shown in Table VI.

(d) Strategies for Growth

At this point Reynolds' ability to grow in Western Europe appears to be limited since they are basically a one brand company in this region. As a matter of fact, their

TABLE VI

RJR Tobacco Patents from July 1, 1991, to March 31, 1992

Smoking Article and Premier Type Articles
11 US Patents
1 EPO Publication

Tobacco Flavors
4 US Patents

Measurement and Analysis
1 US Patent
1 EPO Publication

Low Sidestream - Cigarettes/Paper
7 US Patents
1 EPO Publication

Machine Vision
1 US Patent

Denicotinization
1 US Patent

Filters - Articles/Process
3 US Patents

Tobacco Processes - Expansion
4 US Patents

Tobacco Processes - General
1 US Patent

Cigarette Flavor Modification or Delivery Modification
2 US Patents

Packaging/Packaging Machinery Engineering
2 US Patents
2 EPO Publications

Cigarette Making
1 US Patent

Quality Control
1 US Patent

dependence on Camel would appear to make them somewhat vulnerable. In July, 1992, it was announced that Reynolds had reached a preliminary agreement with Tabacalera S.A to set up a company to make and distribute Camel and Winston cigarettes in Spain. Reynolds' tobacco factory on La Palma, Canary Islands, would form part of the new company. In that both Winston and Camel have been produced in Spain by Tabacalera under license since 1983, this agreement would appear to be primarily financial in nature. The statement issued by both companies indicated that the new arrangement will permit Reynolds to participate in a more equitable way in the local cigarette market. Reynolds also recently launched Winston Gold (sold in the US as Winston Medium) in Spain (no sales data are available). Given the fact that Spain is essentially a full flavor market, this low tar entry would not appear to have a great deal of potential at this time.

As far as other areas within Europe are concerned, Reynolds has adopted an extremely aggressive policy in acquiring or building new factories. Reynolds has started construction of a new factory in Torbali, Turkey. Construction of the 135,000-square foot plant is expected to be completed in mid-1993 at a cost of $50 million, with an initial production capacity of 10 billion units. The factory is part of a $100 million investment earmarked for Turkey. Reynolds announced in 1992 that it had acquired the Satoraljuajhely factory in Hungary. This factory, the last in Hungary to be sold, is now owned 85% by Reynolds and 15% by the employees. Located in the northeastern part of the country, it has an annual capacity of 5.5 billion units and had a 1991 pre-tax profit of 123 million forints on gross sales of 4.8 billion forints. Reynolds is also building a new $33 million cigarette factory in Piaseczno, near Warsaw, which is due to come on-stream by the third quarter of 1993. The factory is planned to have an annual capacity of 8.6 billion cigarettes. Camel will be its first brand.

Reynolds' most extensive acquisitions have been in Russia and the Ukraine. In the Ukraine, Reynolds acquired a 70% interest in two of the four factories there, the Lviv and the Kremenchuh factories. The Ukrainian government has the remaining 30% ownership. These two factories produce about one-fourth of the Ukraine's 80 billion cigarettes, and with improvements that Reynolds has committed to make, will produce about 25 billion units. Reynolds will produce "high-quality and affordable local filtered, non-filtered and papirosy cigarettes, using primarily local tobacco and materials." RJR brands, such as Camel and Winston, are expected to be introduced later. Reynolds has also acquired a 52% interest in the former AS-Petro factory, now called RJR-Petro, in St. Petersburg. The remaining share of the factory resides with the employees. The factory has 1400 workers, a capacity of 15 billion cigarettes, and is the largest cigarette factory in Russia. Reynolds expects to be able to increase capacity to 22 billion units following a modernization program. As was the case with Reynolds' investment in the Ukraine, initial production will be devoted to the ten existing local brands currently being manufactured.

b. Other Competitors

Although the competitors discussed above certainly represent our major competitors in both Western and Eastern Europe, there are other companies which cannot be ignored. Austria Tabakwerke (ATW) already has a 0.7% share in Western Europe, and is aggressively attempting to expand this share, particularly in Germany. In addition, ATW plans to expand into Eastern Europe. It, of course, owns 20% of the Eger factory, is expected to purchase a 50% investment in a factory in Poland, and is currently discussing a possible investment in the Ukraine. Denmark's Skandinavisk Tobakskompagni (ST) is in a similar situation. The company already dominates the Scandanavian market, and has successfully introduced its Prince brand into Germany. Introductions into other Western European countries are planned. ST is also expanding into Eastern Europe. A factory has been purchased in Lithuania, and negotiations are in progress for a factory in Poland. Even TEKEL, the Turkish monopoly, has plans to begin exporting outside of Turkey, but nothing is known regarding those strategies which might be adopted.

Lastly there is Japan Tobacco. JT, which manufacturers the world's second best selling cigarette, Mild Seven, previously had no presence in Europe. Although they signed an agreement with Rinsoz & Ormond in 1990 to produce a small number of Mild Seven cigarettes, these cigarettes were for export to Taiwan. In early 1992, JT acquired the UK-based Manchester Tobacco Company (MTC) for $8.9 million. MTC, which produces about 1.5 billion cigarettes a year, accounts for about 1.5% of the UK market with brands such as Kings and own-label products, and also exports cigarettes to East-Asian markets. It is possible that JT will begin to penetrate the European market, and further purchases are possible. If for no other reason, JT must be taken seriously because of their commitment to new technology, as demonstrated by their long-standing flow of patents. In the nine-month period from July 1, 1991, to March 1, 2992, 38 patents were issued to JT. If the world cigarette market should ever shift from today's cigarette to some type of non-conventional product, JT will certainly be a major player.

V. R&D Plan

A. Introduction

In order to address the R&D issues outline above, nine programs have been established. These programs are: Operations Support, Reconstituted Tobacco, Expanded Tobacco, Product Development, New Product Technology, The Competitive Environment, New Process Technology, Environmental Tobacco Smoke, and External Issues. Each of these programs is outlined in the next section. For each program there is an issue and an objective followed by key strategies that are in large part derived from the external analysis which was carried out in the previous section.

B. R&D Programs

1. Operations Support

a. Product Quality

(1) Issue:

How do we optimize the quality of our products to meet consumer expectations, while at the same time minimizing those efforts which do not actually address consumer desires?

(2) Objectives:

Ensure that our products strictly adhere to the highest standards of quality with respect to consumer expectation, and that product quality serves as a competitive advantage.

(3) Strategies:

Develop, together with Marketing, a program to address the consumer's perception of quality and use it, along with consumer complaint data, to ensure that quality programs meet consumer needs.

Continue to support the new visual quality audit, prepared in collaboration with PM USA, in all affiliates and licensees.

Provide PM Europe affiliates and licensees with the technical support to improve the visual quality of their products.

Provide PME affiliates and licensees with product, material, and ingredient specifications.

Monitor PM products in the Regions in order to ensure that they will comply with PM specifications.

Develop, in conjunction with FTR, a new foil mentholating machine.

b. Raw Material Quality

(1) Issue:

How do we ensure that raw materials meet PM quality standards while addressing the inevitable increase in sample load, and how can we set optimum specifications for non-tobacco materials to minimize variations in the performance of the finished product?

(2) Objective:

Continue to monitor both tobacco and non-tobacco materials using new technology where applicable, and whenever possible establish non-tobacco materials' specifications based on finished product performance.

(3) Strategies:

Finalize new inspection procedures for ingredients, filter additives, and adhesives.

Complete the revision of packaging material specifications in collaboration with Packaging Engineering EEC.

Monitor sufficient numbers of tobacco lots to ensure that all PM Europe blends will result in cigarettes meeting PM specifications by using the available prediction model.

Continue the development of vendor partnering programs which will allow the amount of effort required to inspect incoming non-tobacco materials by all PM Europe QA Departments to be reduced.

Monitor a sufficient number of raw material samples to ensure that PM specifications are adhered to.

Complete the development of near infrared (NIR) methods as a production QA tool for the indication of any corrective measures necessary prior to the application of flavors and casings, and investigate other applications for NIR in the QA area.

Investigate the development of new technologies utilizing FT/IR which will be useful in the area of incoming materials specifications.

c. Productivity Improvements

(1) Issue:

How should R&D support Operations with respect to improvements in factory productivity achieved through cigarette component quality?

(2) Objective:

Contribute to factory productivity improvements and waste reduction by ensuring that materials are specified to optimize machinability while minimizing down time and rejects.

(3) Strategies:

Continue the qualification of new plug wrap/tipping paper combinations which improve machinability and will reduce rejects related to filter attachment.

Develop, in conjunction with our suppliers, new cigarette papers with improved machinability on higher speed makers.

Qualify European suppliers for NTM's currently supplied ex USA, as dictated by business conditions.

Qualify chlorine-free wood pulp paper as a potential replacement for flax/hemp/esparto papers on the Pan European Marlboro in order to provide cost benefits.

Assist PM Europe factories in improving filter consistency, quality, and machine efficiency, while reducing waste of material and manufacturing costs.

Coordinate a program with Engineering and the factories to identify and implement improvements in procedures for the control and measurement of filter weight and plasticizer application level.

Continue the qualification of new and/or alternative ingredients and contribute to QA and cost optimization programs.

d. Quality Assurance Standardization

(1) Issue

How do we standardize our Quality Assurance functions at all locations where PM products are manufactured in order to ensure uniformity of product performance and product quality?

(2) Objective:

Provide and distribute quality assurance know-how throughout the EEC and EEMA Regions.

(3) Strategies:

Provide all PM Europe manufacturing sites with technical support in the areas of QA systems, organization, methods, equipment, and procedures to meet PM quality standards.

Continue to implement and monitor the PM infestation control program in all licensee and affiliate locations.

Train all PM Europe tobacco suppliers on proper fumigation practices according to PM standard operating procedures for phosphine fumigations.

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Implement general quality assurance training programs for licensees and contract manufacturers.

Provide PME affiliates and licensees with the appropriate methodology to monitor subjective quality of production through the maintenance of trained smoking panels.

e. Quality Management

(1) Issue:

How do we manage our overall quality program to ensure that the required objectives are met, while, at the same time, ensuring that the cost of quality is justified?

(2) Objective:

Provide optimal quality at an appropriate cost through an efficient quality management program.

(3) Strategies:

Implement a total quality management program in all PM Europe factories, with an initial goal of improving the quality assurance management system so as to be in compliance with ISO recommendations.

Develop a plan for a program which addresses the cost of non-quality.

Continue to address standardization of QA methods and procedures through expert working groups in the areas of incoming materials, primary QA, filter QA, smoking laboratory, and panels.

f. Process Development

(1) Issue:

How should R&D support Operations with respect to process technology in order to optimize factory productivity?

(2) Objective:

Modify, develop, and evaluate existing and new processes in order to meet Operations requirements of both PME regions in the areas of productivity, yield, quality, and/or other needs.

(3) Strategies:

Provide technical assistance and support to affiliates and licensees in the areas of tobacco processing and specific blend component processing such as stem treatment and BBS.

Assist in the definition of primary layouts, processing parameters, equipment selection, and evaluation for primary extensions or new

primaries, particularly in the Eastern European factories. Provide extensive support to EEMA Engineering Project Management and affiliate Engineering in order to implement primary processing projects.

Ensure that processes and unit operations are, to the maximum extent possible, standardized and in line with PM philosophy when qualifying new or modified equipment, and that the resulting product is properly evaluated.

Continue to evaluate quality and processing parameters in the primaries and identify the impact of processing changes on product quality in order to make recommendations to further improve operations of affiliates and licensees.

Maintain and up-date the PM Europe Primary Information Manual and complete the factory comparisons.

Adapt the PM USA Good Manufacturing Practices (GMP's) and Tobacco Processing Specifications for the European factories and implement this program in co-ordination with other groups within and outside R&D.

2. **Reconstituted Tobacco**

a. Issue:

How do we ensure sufficient quantities of reconstituted sheet materials for our future needs?

b. Objective:

Develop and implement Process Development programs in the area of reconstituted tobacco materials to achieve optimal sheet quality and feedstock utilization to meet the business requirements of both PME Regions.

c. Strategies:

Continue to monitor and assess, in collaboration with PM Europe and PM USA Leaf Departments and R&D, our company's world wide sheet requirements and capacities. Should the need for a European sheet facility arise, provide support for a pre-engineering study concerning this plant.

Develop programs to evaluate, qualify, and implement the use of alternate reconstituted sheet materials to those made in PM USA or by other current suppliers and evaluate sheet products from new suppliers.

Assist in the PM USA development of the Cast Leaf (CL) and New Blended Leaf (NBL) processes, and evaluate and qualify these sheet products in European cigarettes.

Provide assistance to ensure that sheet facilities in new factories or factories which are purchased during the plan period are optimized.

Continue to optimize the utilization of OTM's with respect to all existing and new reconstitution processes with emphasis on new fines generators.

Standardize the humectant level in reconstituted tobacco so that PME is in line with current German and future US levels.

3. Expanded Tobacco

a. Issue:

How do we ensure that the four European expanded tobacco (ET) locations meet the future requirements for expanded tobacco?

b. Objective:

Develop and implement Process Development programs in the area of ET so as to meet optimal product quality, best possible level of interchangeability, and adequate safety standards.

c. Strategies:

Develop, implement, and follow up programs which will optimize ET processing and product quality at all locations.

Provide assistance to affiliates in the implementation of process improvements, standardization, blend modifications, and ensure adequate distribution of process know-how among affiliates.

Establish and implement ET product and processing specifications and targets in Europe to achieve optimal product uniformity and quality.

Provide Process Development assistance for the evaluation of NET Products in European cigarettes in conjunction with Product Development and the Leaf Department.

Participate in the definition of processing parameters of the new DIET/NET facility in BOZ and provide support for the start-up of equipment and evaluation of ET products.

Continue to provide technical support to licensees (MT Bologna) to evaluate and qualify ET blend modifications or ET incorporation into new PM cigarettes.

Implement the concept of a European DIET Safety Committee together with affiliates. Participate as R&D member and co-ordinate process safety matters between PM USA and Europe. Assist the affiliates in the implementation of the recommendations resulting from the Kellogg hazard review program and provide assistance as a follow-up to specific incidents.

4. Product Development

a. Issue:

How do we reposition our current brands and introduce brand extensions and new brands to assure coverage of the important market segments?

b. Objective:

Optimize the performance of our existing products and develop new products based on business objectives with the highest possible level of consumer acceptance.

c. Strategies:

Develop new products for the EEC market to take advantage of growing market segments, new market niches, and competitor vulnerability in order to ensure that PM volume continues to increase in these markets.

Develop new products for the EEMA market which are tailored to meet local consumer desires and are affordable.

Ensure product standardization within brand families and clear differentiation of product performance between brand families.

Maintain, in collaboration with Market Research, the computerized model in which market dynamics are correlated with measurable and subjective product attributes.

Advise Market Research in qualitative and quantitative design and content of consumer test questionnaires in order to improve our interpretation and understanding of consumer test results.

Implement programs aimed at substituting important product components such as:

- DIET by NET
- RL/TC ex PM USA by RL ex LTR
- Licorice by flavor concentrate

5. New Product Technology

a. Issue:

How do we identify and evaluate new product technology which will allow us to be a leader in innovative product concepts and will enable us to respond to competitive challenges?

b. Objective:

Increase the effectiveness in technology management in order to improve product innovation and create new and innovative ideas/concepts for the cigarette market.

c. Strategies:

Monitor cigarette technologies developed within and outside of the corporation on a world wide basis to identify potential areas of application and maintain a technology "storehouse."

Strengthen our know-how in the area of technology-product relationships in order to:

(1) Improve our mathematical prediction models to enable rapid achievement of product objectives for mainstream and sidestream smoke deliveries; and

(2) Select and assess key technologies for the development of innovative products.

Develop specifically the following selected technologies to the stage of industrial application:

- Total blend expansion
- Tobacco sheet filter
- Cellulose acetate web filter
- Tobacco sheet cigarette wrapper
- Tobacco extract flavors
- Flavors on cigarette paper
- On-line laser perforation
- Novel methods for production of tobacco-identical flavors
- Tow blackening
- DHS filters

Subjectively evaluate cigarettes with filters modified to alter smoke exit flow patterns to determine the effect of different exit patterns on subjectives.

Develop technologies for the reduction of sidestream visibility in conjunction with PM USA R&D which will:

(1) Provide 70% reduced visibility with a minimal subjective deficit; or

(2) Lead to a stepwise reduction in sidestream so that subjective changes are imperceptible.

Evaluate the potential consumer benefits of reduced sidestream, through reduction of total tobacco, on low tar cigarettes.

Develop technology applicable to ultra low tar products.

Develop and apply a screening system that can be used to select the most attractive opportunities from our inventory of all new and innovative product ideas generated within the company.

Collaborate with PM USA R&D Product Evaluation Division in the development of new methodologies to assess consumer acceptance of new product concepts.

6. The Competitive Environment

a. Issue:

How do we obtain and utilize competitive intelligence in order to be able to evaluate and rapidly respond to potential competitive threats?

b. Objective:

Monitor competitive activities in order to ensure that PM products, technology, and quality are superior to those of the competition.

c. Strategies:

Audit PM and competitor products in the Regions in order to monitor trends and provide data regarding competitors' quality.

Maintain our internal descriptive panel in order to build a consistent data base on subjective product attributes of competitive products.

Monitor the evolution of key competitive products by making optimum use of our current cigarette information activities, and ensure rapid awareness of competitors' new product introductions.

Monitor competitive cigarette technology in order to be able to anticipate future trends in new product development.

Assure that sidestream visibility of PM products are in compliance with future internal guidelines and provide market-place surveys.

Maintain a detailed competitive intelligence effort to determine potential threats from the activities of current and potential competitors.

7. New Process Technology

a. Issue:

How do we identify and evaluate new process technology which will allow us to maintain product quality leadership in the industry?

b. Objective:

Develop, evaluate, and implement new processing technologies which will result in further improved product quality, better processing yield, or increased productivity.

c. Strategies:

Actively support the implementation of cut filler recovery technology from winnowers in European affiliates.

Complete the evaluation program of the new Hauni HT tunnel prior to the dryer in the Miniprimary.

Provide assistance to FTR in Onens regarding the evaluation and qualification of the combined direct cylinder conditioning and casing application unit in the new ET feedstock processing line.

Keep abreast of processing technologies developed by R&D Richmond and other PM company R&D facilities, equipment suppliers, and other companies to evaluate their potential application in our primaries.

8. Environmental Tobacco Smoke

a. Issue:

How do we confront attacks on PM and our industry based on presumed health risks of environmental tobacco smoke?

b. Objective;

Assess the impact of environmental tobacco smoke (ETS) on indoor air quality, and investigate potential methods of altering the chemistry of ETS.

c. Strategies:

Conduct investigations on the potential formation of undesirable components in aging ETS and assess how they might be controlled.

Participate in industry programs to develop and recommend analytical methodology for use by industry and government.

Develop and use portable monitoring equipment to evaluate indoor air quality in public structures and transportation.

Evaluate literature methods which propose the use of analytical markers as an index to measure exposure to ETS.

Collaborate with PM USA R&D in developing methodologies to alter the chemistry of sidestream smoke.

Support Science and Technology in their investigations on ETS.

9. External Issues

a. Issue:

How do we anticipate and satisfy all the regulatory requirements arising from external pressures on our products and processes?

b. Objective:

Ensure that blend components, non-tobacco materials, finished products, and packaging comply with existing and future legal requirements in both the EEC and EEMA Regions and that affiliates and licensees modify processes whenever necessary to comply with internal directives and external requirements.

c. Strategies:

Monitor pesticide residues on incoming tobacco lots, finished products, potential leaf purchases, and potential exports to the USA with a frequency based on legal requirements and sound statistical practices.

Develop rapid screening methods for pesticides which will allow a significant reduction in workload while maintaining a high level of reliability.

Monitor ingredient levels in cigarette, packaging, and manufacturing materials either currently being used or being evaluated for qualification.

Extend analytical capabilities for pesticides and ingredients for which legislation is being proposed or which are considered undesirable in, or in contact with, our products.

Establish a data base for analytical methods which would ensure that results obtained during any period of time can be related to a specific analytical method.

Develop a plan to pursue the significant reduction of TSNA in mainstream smoke, and initiate a research program in this area.

Identify areas of processing which may pose environmental impact problems in the future and provide Process Development support for ECO Audits of existing and new facilities in both PME Regions.

Develop a long-term plan for the further reduction of the tar deliveries of our brands so as to comply with the 1998 EEC tar ceiling regulations, including the evaluation of emerging technologies for low tar/high taste.

Develop, in conjunction with Packaging Engineering in Lausanne, new materials which can be used to meet potential legislation regarding packaging recyclability.

Contribute, through contact with suppliers and governmental authorities, to the registration of PM recommended infestation control products.

Develop, together with suppliers, new adhesives for cigarettes and packaging materials which are based on naturally occurring substances.

Develop a battery of analytical tools for emissions and effluents.

Investigate the development of filtration and scrubbing techniques.

Establish Material Safety Data Sheets for casing and flavors.

Continue to interact with other PM Europe Companies to ensure harmonization of environmental programs.

Continue to ensure that PM products are properly tested by governmental laboratories, thereby avoiding problems which could prevent the sale of our products in certain markets.

Identify regulatory issues of corporate concern in the EEC and EEMA Regions, advise management concerning their technical and legal ramifications, and represent the industry's interests through interactive programs with scientific and norm associations.

VI. Action Plans

A. Introduction

Strategies represent a broad approach to solving a particular problem and are based on both the definition of the objective the strategy addresses as well as an analysis of as much of the background data as possible; that is, an internal and external situational analysis. The next section outlines a summary of the action plans which have been specified to accomplish each strategy. The organization of this section is the same as that used for the R&D Plan in Section V. The vast majority of the strategies identified in Section V are covered. There are a few which have been omitted. In every case these are strategies for which no plan can be specified, because our approach depends on receiving an external request which we cannot define at this time.

B. Strategies and Plans

1. Operations Support

a. Product Quality

(1) Develop a program to address the consumer's perception of quality and use it to ensure that quality programs meet consumer needs - This program has a number of milestones which are scheduled to be completed in 1993; namely:

(a) Develop a Customer Perception of Quality Program which will include obtaining relevant information from PM USA and organizing consumer surveys in relevant countries - end of 2nd quarter, 1993.

(b) Standardize customer complaint definitions within PME by using, where possible, VQA standard definitions - 2nd quarter, 1993.

(c) Identify the twenty most frequently encountered customer complaints by both country and production center - end of 2nd quarter, 1993.

(d) Establish a procedure for the acquisition, evaluation, and exchange of customer complaint information between R&D and Marketing - end of 2nd quarter, 1993.

(e) Review VQA standards so as to ensure that those defects which are most likely to result in customer complaints are emphasized - 4th quarter, 1993.

(f) Make use of the Customer Perception of Quality Program and customer complaint information to target product quality improvements - 4th quarter, 1993.

(2) Continue to support the new visual quality audit, prepared in collaboration with PM USA, in all affiliates and licensees - By the end of 1993 all EEC affiliates will have both the required information and training in order to implement the system. New EEMA affiliates are expected to take two years to complete the process from start to finish.

(3) Provide PME affiliates and licensees with the technical support to improve the visual quality of their products - There are four distinct activities which are scheduled to be carried out in 1993 in order to support this strategy. These are:

(a) Provide trouble-shooting to the factories through machinery improvements and continue to fine tune the new VQA with emphasis on operators' and auditors' training by visiting 10 factories in 1993 according to a schedule to be established by AOD-EEC/EEMA.

(b) Continue to promote modern quality systems on the factory floor leading eventually to operator control in three factories in 1993; most likely, one factory in Italy, Izmir, and FTR.

(c) Develop tools to promote the visual defect index (VDI) in our factories and specifically implement VDI PC application in five factories by the 4th quarter of 1993.

(d) Assist secondary machinery buyers, such as EEMA Engineering and certain affiliates, in applying the standard PM USA assessment procedure at the vendor. The required information will be transferred to EEMA Engineering by the 1st quarter of 1993, and to Philsa as soon as the appropriate personnel are hired.

(4) Provide PME affiliates and licensees with product, material, and ingredient specifications - This activity will be ongoing throughout the plan period. Plans are to continue to provide correct specifications for cigarettes, filters, NTM's, casings, and flavors to the manufacturing centers, and to ensure that specifications are updated when appropriate.

(5) Monitor PM products in the Regions in order to ensure that they will comply with PM specifications - A concept for improving the monitoring reports on all aspects of quality for licensees and affiliates will be developed by mid-1993 and implemented by the end of 1993. In addition normal monitoring activities will be ongoing throughout the plan period.

(6) Develop, in conjunction with FTR, a new foil mentholating machine - This activity will be carried out in order to ensure that product quality is maintained and to ensure that future materials, such as inner wraps with no aluminum foil, can be used - end of 1993.

b. Raw Material Quality

(1) Finalize new inspection procedures for ingredients, filter additives, and adhesives - The finalization of these inspection procedures is scheduled to be completed by the end of 1992. Following this a number of documents which will be appended to the inspection procedure will be reviewed, updated, or created. These documents will cover: 1) material specifications; 2) guidelines for the qualification of new or modified ingredients, filter additives, and adhesives; 3) final inspection reports for related materials; 4) establishing piling cards for related materials; and 5) correlation procedures with suppliers - end of 1994.

(2) Complete the revision of packaging material specifications in collaboration with Packaging Engineering EEC - There are two activities regarding this strategy which will be carried out in 1993; namely:

(a) Revise and develop testing methods and finalize discussions with suppliers for the introduction of all related MQA quality tools dealing with polypropylene film specs - end of 1993.

(b) Develop the specifications, testing methods and technical sheets for tear tapes and new inner liners. Discuss introduction at the suppliers and finalize the introduction of all related MQA quality tools - end of 1994.

(3) Monitor sufficient numbers of tobacco lots to ensure that all PME blends will result in cigarettes meeting PM specifications - This activity will be ongoing throughout the plan period.

(4) Continue the development of vendor partnering programs - A specific milestone for this activity to be accomplished in 1993 is the transferring of the present PC system on to the mainframe and entering ingredient, filter additive, and adhesive specifications into the system. In addition an ongoing activity will be to continue to evaluate suppliers. Those suppliers which show an outstanding SOR rating will only be monitored in the future. Suppliers which do not achieve an outstanding SOR rating will continue to be audited and must also adopt PM proposed improvement programs.

(5) Monitor a sufficient number of raw material samples to ensure that PM specifications are adhered to - This activity will continue throughout the plan period.

(6) Complete the development of NIR methods as a QA tool for the application of flavors and casings and investigate other applications of NIR - The current work on flavors and casings is scheduled to be completed in January, 1993. Future applications, particularly the use of NIR to monitor menthol on foil and as a tool for OV measurements, will be evaluated, and a plan will be written in the 1st quarter of 1993.

(7) Investigate the development of new technologies utilizing FT/IR which will be useful in the area of incoming materials specifications - Potential areas of application will be investigated during the 4th quarter of 1992, and a plan will be written in the 1st quarter of 1993.

c. Productivity Improvements

(1) Continue the qualification of new plug wrap/tipping combinations - With respect to plug wrap the two major milestones for 1993 will be to complete machinability trials for Schoeller & Hoesch Fu-Pov 12,000 plug wrap at FTR, Munich and Berlin in the 1st quarter of 1993 and to improve the quality of Schoeller and Hoesch Fu-Pov 3,000 plug wrap to match the quality of de Mauduit PPW 33 in the 4th quarter of 1993. With respect to tipping paper major milestones will be: 1) qualify the new white base

paper Blancophan 400 from Benkert in the 2nd quarter of 1993; 2) complete the qualification procedure for upgraded cork base papers from Tann and Benkert by the 1st quarter of 1994; 3) and qualify a white base paper from Tann by the 1st quarter of 1994.

(2) Develop new cigarette papers with improved machinability on higher speed makers - Two activities will be completed in this area in 1993; namely: 1) finalize the qualification of 137-1 HFE paper from de Mauduit in the first quarter of 1993; and 2) qualify Pela 25 Mn and 87 Mn papers from Schoeller and Hoesch in the second quarter of 1993.

(3) Qualify European suppliers for NTM's currently supplied ex USA as dictated by business conditions - This strategy involves two materials currently supplied by the US for BOLD type products; namely, the paper and the filter. It is planned to qualify de Mauduit as a supplier of the current Kimberly-Clark 10-058 A paper by the end of 1993, and to qualify Filtrona GB as a supplier of the current Filtrona USA filter, also by the end of 1993.

(4) Qualify chlorine-free wood pulp paper as a potential replacement for flax/ hemp/esparto papers on the Pan European Marlboro - Samples of potential wood pulp papers from all PM approved cigarette paper suppliers will be evaluated; cigarettes will be made and evaluated; and machinability tests will be run - 4th quarter, 1993.

(5) Assist PME factories in improving filter consistency, quality, and machine efficiency, while reducing waste of materials and manufacturing costs - A number of activities are planned in support of this strategy, and these are listed below:

(a) Study the influence of machine settings, type, and physical condition of rollers on RTD variations, machine breakdowns, and weight of tow - 2nd quarter, 1993.

(b) Eliminate the "wet and dry" measurement method for triacetin determination in filter rods by using the Filtrona FPZ-100 NIR rapid analyzer - 1st quarter, 1993.

(c) Eliminate, if feasible, the production of filter rods outside RTD tolerances due to slow-down during bobbin splicing through the potential use of a modified bobbin changer currently being evaluated at FTR - 4th quarter, 1993.

(d) Based on positive results obtained at PM USA discuss, with PARK/ EEMA Engineering the feasibility of speeding up a filter maker from 400 to 500 m/min at PM Europe and evaluate the impact on quality - 1st quarter, 1993.

(6) Coordinate a program with Engineering and the factories to identify and implement improvements in procedures for the control and measurement of filter weight and plasticizer application level - The following milestones have been identified for this strategy:

(a) Study the influence of machine settings, type, and physical condition of rollers on tow only weight - 2nd quarter, 1993.

(b) Confirm results of the Eastman study concerning the time required for the triacetin level to reach equilibrium and, if confirmed, evaluate PM USA modifications to the Hauni plasticizer applicator system - 1st quarter, 1993.

(c) Inform affiliates regarding results of these studies, and ensure that the necessary modifications are implemented - 1st quarter, 1994.

(7) Continue the qualification of new and/or alternative ingredients and contribute to QA and cost optimization programs - Three milestones have been identified for this strategy during 1993; namely:

(a) Finalize the introduction of concentrated base flavors in Europe - 1st quarter, 1993.

(b) Finalize the introduction of the "Thoresen cochise," using 100% ground JST cocoa shells, within the PME affiliates - 1st quarter, 1993.

(c) Finalize the qualification of a new invert sugar from Borgwald - 2nd quarter, 1993.

d. Quality Assurance Standardization

(1) Provide all PM Europe manufacturing sites with technical support in the areas of QA systems, organization, methods, equipment, and procedures to meet PM quality standards - This strategy involves a considerable amount of ongoing activity as well as specific projects with clear completion dates. Those projects which are particularly important are listed below:

(a) Establish statistically significant tolerances for product and manufacturing specs and harmonize local QA systems in order to obtain fully comparable data - 2nd quarter, 1993.

(b) Establish specifications based on tobacco weight for corporate brands (affiliates) by March, 1993, and for other brands and licensees by the end of 1993.

(c) Provide support in performing incoming inspections for new PME affiliates in the start up phase according to the following schedule: PM-Eger, 1st quarter, 1993; Kutna Hora, 4th quarter, 1993; Russia, initiate in 1993.

(d) Provide technical training on material quality related activities for new affiliates on-site and at Neuchâtel according to the following schedule: PM-Izmir, 2nd quarter, 1993; Kutna-Hora; initiate in 1993; Russia, initiate in 1993.

(e) Further develop the "auditing checklist" (PME Method 831) - 1st quarter, 1993.

(f) Develop and implement QA systems for new affiliates according to the following schedule: CSFR, end of 1993; Poland, end of 1993; St. Petersburg, mid-1994.

(g) Develop a simple automatic weighing and reporting system for OV for application on PC's at Kutna-Hora - 1st quarter, 1993.

(h) Develop a complete reporting system for primary data, possibly at Eger - 2nd quarter, 1993.

(i) Bring PME Method system in line with ISO 9000 and clearly define responsibilities - 4th quarter, 1993.

(j) Create and manage central documentation files concerning QA instrumentation thus ensuring standardization throughout the Regions - Ongoing.

(2) Continue to implement and monitor the PM infestation control program in all licensee and affiliate locations - This strategy requires an ongoing effort throughout the plan period; however, it should be noted that because of the increasing number of affiliates, the work load is expected to increase significantly.

(3) Train all PME tobacco suppliers on proper fumigation practices according to PM standard operating procedures - 3rd quarter, 1993.

(4) Implement general quality assurance training programs for licensees and contract manufacturers - This effort will continue throughout the plan period; however, a specific milestone is to coordinate a training program on statistical process control for Philsa by the 2nd quarter of 1993.

(5) Provide PME affiliates and licensees with the appropriate methodology to monitor subjective quality of production through the maintenance of trained smoking panels - Training for all factory panels will be completed by the end of 1993.

e. Quality Management

(1) Implement a total quality management program in all PM Europe factories, with an initial goal of improving the QA management system so as to be in compliance with ISO requirements - Work will be carried out in 1993 in order to develop and test reference documentation with the following time table:

(a) Develop and test initial audit check list - 1st quarter, 1993.

(b) Prepare a training package for the local ISO coordinators in the factories - 2nd quarter, 1993.

(c) Train and qualify one individual for the position of Lead Auditor - 4th quarter, 1993.

(d) Prepare the common standard quality-system documentation that can be used by all affiliates - ongoing throughout 1993.

(e) Coordinate and lead activities related to the European ISO coordinators team - ongoing throughout 1993.

(2) Develop a plan for a program which addresses the cost of non-quality - Perform a pilot analysis of the cost of non-quality in one or two European factories using an outside consultant with initial results scheduled to be obtained by the 2nd quarter of 1993.

(3) Continue to address standardization of QA methods and procedures through expert working groups in the areas of incoming materials, primary QA, filter QA, smoking laboratory, and panels - Most of the effort devoted to this strategy is ongoing throughout the plan period; however, the following specific milestones should be noted:

(a) Establish a PME method for the calculation of tow only weight, describing standard procedures for the determination of total rod weight, triacetin weight, and paper and glue weight - 3rd quarter, 1993.

(b) Finalize PME methods for temperature measurement, cut width for stems, and OV monitor for tobacco preparation - 4th quarter, 1993.

f. Process Development

(1) Provide technical assistance and support to affiliates and licensees in the areas of tobacco processing and specific blend component processing such as stem treatment and BBS - Activities addressing this strategy will be ongoing throughout the plan period.

(2) Assist in the definition of primary layouts, etc., for primary extensions or new primaries. Provide extensive support to EEMA Engineering Project Management and affiliate Engineering in order to implement primary processing projects - There are several specific activities directed toward the accomplishment of this strategy; namely:

(a) Assist technical staff in Dresden with the upgrade of the Dresden primary - 4th quarter, 1993.

(b) Provide technical support for the new primary and stem line in Kutna-Hora - 3rd quarter, 1994.

(c) Initiate assistance to both Poland and Russia with primary engineering - by end of 1993.

(3) Ensure that process and unit operations are standardized and in line with PM philosophy when qualifying new or modified equipment, and that the

resulting product is properly evaluated - Activities in support of this strategy will be ongoing throughout the plan period.

(4) Continue to evaluate quality and processing parameters in the primaries and identify the impact of processing changes on product quality in order to make recommendations to further improve operations of affiliates and licensees - A new quarterly report for the tobacco processing quality program with improved analysis and interpretation of the data will be developed. The scheduled completion date is in the 3rd quarter of 1993.

(5) Maintain and up-date the PM Europe Primary Information Manual and complete the factory comparisons - The DIET processing section is scheduled to be completed in March, 1993, and the factory comparisons should be completed by June, 1993. Up-dates to the Manual will be made on a yearly basis.

(6) Adapt the PM USA GMP's and Tobacco Processing Specifications for the European factories and implement this program in co-ordination with other groups within and outside R&D - A program addressing this strategy will be initiated in 1993 with support from Operations Management. Completion is scheduled for the 3rd quarter of 1994.

2. **Reconstituted Tobacco**

a. Continue to monitor and assess our company's world wide sheet requirements and capacities - Participation in the total utilization program for PM sheet materials and their associated feed stocks will be an ongoing activity during the plan period.

b. Develop programs to evaluate, qualify, and implement the use of alternate reconstituted sheet materials, and evaluate sheet products from new suppliers:

(1) Define source of flavors for future LTR-TC sheet production runs - 1st quarter, 1993, if a final decision is made to switch to the new LTR product.

(2) Complete the evaluation of sheet products from Deli-HTL in Eindhoven - 2nd quarter, 1993.

c. Assist in the PM USA development of the CL and NBL processes, and evaluate and qualify these sheet products in European cigarettes:

(1) Carry out qualifications of NBL sheets starting in the first half of 1993 and CL in the second half of 1993.

(2) Participate in pilot plant and production trials in PM USA Richmond on a twice yearly basis.

d. Provide assistance to ensure that sheet facilities in new factories, or in factories which are purchased during the plan period, are optimized - If the Hodonin facility is retained, we have committed to evaluate current products and participate in process improvements by the end of 1993. Depending on events, similar involvement may be required for Poland starting in 1993.

e. Continue to optimize the utilization of OTM's with respect to all existing and new reconstitution processes with emphasis on new fines generators - Activities directed toward this strategy will be ongoing throughout the plan period.

f. Standardize the humectant level in reconstituted tobacco so that PME is in line with current German and future US levels - Initiate tests in order to qualify the new reconstituted sheet with respect to quality - 1st quarter, 1993.

3. Expanded Tobacco

a. Develop, implement, and follow up programs which will optimize ET processing and product quality at all locations - Standardization is scheduled to be complete in September, 1993, and optimization, by September, 1994.

b. Provide assistance to affiliates in the implementation of process improvements, standardization, blend modifications, and ensure adequate distribution of process know-how among affiliates - Activities directed toward accomplishing this strategy will be ongoing throughout the plan period.

c. Establish and implement ET product and processing specifications and targets in Europe to achieve optimal product uniformity and quality - Should Operations Management approve GMP's for ET, these GMP's will be established by the end of 1993. In case GMP's are not approved, process specifications for ET will be recommended by the end of 1993.

d. Provide Process Development assistance for the evaluation of NET products in European cigarettes in conjunction with Product Development and the Leaf Department - During 1993 we will assist in trials implemented in the Richmond NET pilot plant and will follow up the product evaluation with mini-primary trials. In addition, we will keep abreast of current NET technology development through twice-yearly visits to Richmond.

e. Participate in the definition of processing parameters of the new DIET/NET facility in BOZ and provide support for the start-up of equipment and evaluation of ET products - Work to address this strategy will be initiated in the 1st quarter of 1993 and is scheduled to be completed in the 4th quarter of 1994.

f. Implement the concept of a European DIET Safety Committee together with affiliates. Participate as R&D member and co-ordinate process safety matters between PM USA and Europe. Assist the affiliates in the implementation of the recommendations resulting from the Kellogg hazard review program and provide assistance as a follow-up to specific incidents - The following milestones will be completed in 1993:

(1) The DIET Safety Committee will be fully established by the 2nd quarter of 1993.

(2) The Kellogg hazard review program will be completed by the end of 1993.

In addition, assistance to affiliates will be provided throughout the plan period.

4. Product Development

a. Develop new products for the EEC market to take advantage of growing market segments, new market niches, and competitor vulnerability in order to ensure that PM volume continues to increase in these markets - In order to address this strategy in 1993, a two-pronged response is required. The first activity is to provide EEC Marketing with products that have been requested at NPC meetings. Products identified to date are: a) F6 KS for Germany, b) L&M Extra Lights for France, c) Muratti Ultra for Korea, d) Marlboro and L&M rolls for Germany, e) a low cost lights cigarette for Germany, and f) development of a L&M for Spain.

The second part of the response requires that R&D carry out a thorough analysis of each individual EEC market in order to be able to pro-actively design new products which will be designed to take advantage of specific market conditions. This analysis is a process which consists of the following steps - a) develop a three dimensional picture of the market based on tar segmentation and price segmentation; b) determine how the current PM product portfolio fits into this framework; c) determine consumer preferences and identify market opportunities based on these preferences as well as competitive vulnerability; d) determine product concepts based on identified market opportunities; and e) develop the appropriate products. This type of analysis will be carried out for the four major EEC markets - Germany, Italy, France, and Spain - by the 3rd quarter of 1993.

b. Develop new products for the EEMA market which are tailored to meet local consumer desires and are affordable - The first activity which must be carried out in order to address this strategy is to construct a data base in order to develop a picture of current and future EEMA markets. This activity is scheduled to be completed during the 3rd quarter of 1993. Secondly, a program must be initiated to develop technology to make acceptable cigarettes at low cost and under major constraints as a consequence of limited equipment. A joint product development/process development plan will be developed by the end of the 1st quarter, 1993.

c. Maintain, in collaboration with Market Research, the computerized model in which market dynamics are correlated with measurable and subjective product attributes - This activity will be ongoing throughout the plan period.

d. Advise Market Research in qualitative and quantitative design and content of consumer test questionnaires in order to improve our interpretation and understanding of consumer test results - This activity will be ongoing throughout the plan period.

e. Implement programs aimed at substituting important product components such as:

(1) DIET by NET - When specifications have been established through pilot plant experiments, those brands which will incorporate NET will be determined, and blends will be defined. This is scheduled to be completed by the end of 1993.

(2) RL/TC ex PM USA by RL ex LTR - The product development work is scheduled to be completed by the end of 1992. Implementation depends on a decision to switch to the new LTR product.

(3) Licorice by Flavor Concentrate - The Product Development work is scheduled to be completed by the end of 1992. Implementation should be complete in the 3rd quarter of 1993.

5. **New Product Technology**

a. Monitor cigarette technologies developed within and outside of the corporation on a world wide basis and create new and innovative ideas/concepts for the cigarette market - This activity will be ongoing throughout the plan period.

b. Strengthen our know-how in the area of technology-product relationships in order to: a) improve our mathematical prediction models to enable rapid achievement of product objectives for mainstream and sidestream smoke deliveries; and b) select and assess key technologies for the development of innovative products - This activity will be ongoing throughout the plan period.

c. Develop specifically the following selected technologies to the stage of industrial application:

(1) Total Blend Expansion - The development work on this technology is already complete. Possible implementation of this technology in the areas of low sidestream, low tar rolls, and low cost products, will be evaluated in 1993.

(2) Tobacco Sheet Filter - The current objective is to substitute the paper currently being used in the Merit Ultima filter with tobacco sheet. A report summarizing initial results is scheduled to be issued by mid-1993.

(3) Cellulose Acetate Web Filter - Technology developments at PM USA will be evaluated during 1993.

(4) Tobacco Sheet Cigarette Wrapper - Tobacco sheet wrappers from a number of suppliers will be evaluated during 1993 to determine the performance of these materials. Possible areas of application are for a reduced sidestream product (double wrap) or for an innovative product concept.

(5) Tobacco Extract Flavors - This project must be redefined. A new plan will be drafted during the 1st quarter of 1993.

(6) Flavors on Cigarette Paper - Technology developments at PM USA R&D will be evaluated during 1993.

(7) On-Line Laser Perforation - The effect of this technology on product performance is currently being investigated, and the investigation is scheduled to be completed by mid-1993.

(8) Novel Methods for Production of Tobacco-Identical Flavors - Before technology can be developed to address this strategy, it is necessary to make a decision as to which flavor(s) should be targeted. This can not be done without being able to screen certain tobacco-identical flavors which can only be obtained from a flavor supplier. The goal is to identify a flavor supplier with whom we can work by the 2nd quarter of 1993.

(9) Tow Blackening - The technique which will be investigated to develop this technology uses carbon incorporated into triacetin. The feasibility of this approach will be determined by the 2nd quarter of 1993.

(10) DHS Filters - Support the evaulation of this potential new technology throughout 1993.

d. Subjectively evaluate cigarettes with filters modified to alter smoke exit flow patterns to determine the effect of different exit patterns on subjectives - This study will be completed during the 1st quarter of 1993. Should results warrant it, a plan will be developed for further work in this area by the end of the 1st quarter.

e. Evaluate the potential consumer benefits of reduced sidestream, through reduction of total tobacco, on low tar cigarettes - A plan for this strategy will be developed during the first quarter of 1993.

f. Develop technology applicable to ultra low tar products - Before an approach to developing appropriate technologies can be formulated, a number of key questions in the area of ultra low tar products must be answered. Some of these questions are: a) given the initial success of BOLD, is there any need to continue with the development of 2 mg products which are preferred over Barclay Ultra and R1? b) can BOLD be improved? and c) can the cost of BOLD be decreased either through blend manipulation (total blend expansion) or by changing the filter? These questions must be addressed in the 1st quarter of 1993, so that tactics designed to carry out this strategy can be developed.

g. Develop and apply a screening system that can be used to select the most attractive opportunities from our inventory of all new and innovative product ideas generated within the company - This activity will be ongoing throughout the plan period.

h. Collaborate with PM USA R&D Product Evaluation Division in the development of new methodologies to assess consumer acceptance of new product concepts - This activity will be ongoing throughout the plan period.

6. The Competitive Environment

a. Audit PM and competitor products in the Regions in order to monitor trends and provide data regarding competitors' quality - There are four specific milestones which are scheduled to be reached during 1993 which address this strategy; namely:

(1) Reorganize market surveys so that more surveys can be carried out on strategic markets - 2nd quarter, 1993.

(2) Improve current reports so that information regarding PM and competitors flows more quickly to management - 2nd quarter, 1993.

(3) Organize market surveys on key markets together with Product Development, so that data can be added to the product performance evaluation system - 2nd quarter, 1993.

(4) Together with Marketing define key brands to be sampled on PM Europe markets during the 2nd quarter of 1993, and redefine these brands on a yearly basis.

b. Maintain our internal descriptive panel in order to build a consistent data base on subjective product attributes of competitive products - This activity will be ongoing throughout the plan period.

c. Monitor the evolution of key competitive products by making optimum use of our current cigarette information activities, and ensure rapid awareness of competitors' new product introductions - In order to improve the responsiveness of the CIR system toward company needs, a concept will be developed for a new CIR system, and sampling schemes and frequencies will be adapted so as provide rapid information to Product Development, Product Quality Audit, and Marketing. This concept will be developed by the 2nd quarter of 1993. In addition, an R&D team will be established which will evaluate competitive products on a periodic basis throughout the plan period.

d. Monitor competitive cigarette technology in order to be able to anticipate future trends in new product development - This activity will be ongoing throughout the plan period.

e. Assure that sidestream visibility of PM products are in compliance with future internal guidelines and provide market-place surveys - In support of this strategy, an eight-port visibility apparatus is being constructed in the US and is scheduled to be available to us during the 1st quarter of 1993. Debugging of this equipment, development of a routine method, and preliminary studies are scheduled to be completed in the 2nd quarter of 1993

f. Maintain a detailed competitive intelligence effort to determine potential threats from the activities of current and potential competitors - This activity will be ongoing throughout the plan period.

7. New Process Technology

a. Actively support the implementation of cut filler recovery technology from winnowers in European affiliates - This technology is scheduled to be implemented within EEC affiliates and FTR by the end of 1993.

b. Complete the evaluation program of the new Hauni HT tunnel prior to the dryer in the Miniprimary - The effects of the Hauni HT tunnel on physical quality will be quantified, and the effects on subjective characteristics will be measured. This work will be completed by the end of 1993.

c Keep abreast of processing technologies developed by R&D Richmond and other company R&D facilities, equipment suppliers, and other companies to evaluate their potential application in our primaries - This activity will be ongoing throughout the plan period; however, it will require periodic visits and specific training programs at PM USA R&D in Richmond.

8. Environmental Tobacco Smoke

a. Conduct investigations on the potential formation of undesirable components in aging ETS and assess how they might be controlled - There are three specific milestones which are scheduled to be reached during 1993 in support of this strategy. These are:

(1) Complete the full kinetic analysis of the formation of NNK in gas phase - 1st quarter, 1993.

(2) Complete a study to determine those factors which underlie the observed inhibition of NNK formation - 3rd quarter, 1993.

(3) Study the inhibition of NNK formation under various types of conditions - end of 1993.

b. Participate in industry programs to develop and recommend analytical methodology for use by industry and government - During the plan period PME R&D will provide resources required to support the work of the ETS/SS Coresta Task Force and conduct whatever studies are required.

c. Develop and use portable monitoring equipment to evaluate indoor air quality in public structures and transportation - A full evaluation will be made of new technology (ion mobility analyzer) for the environmental monitoring of nicotine by the 2nd quarter of 1993.

d. Evaluate literature methods which propose the use of analytical markers as an index to measure exposure to ETS - This activity will be ongoing throughout the plan period.

e. Collaborate with PM USA R&D in developing methodologies to alter the chemistry of sidestream smoke - A plan to address this strategy will be finalized in January, 1993.

f. Support Science and Technology in their investigations on ETS - This activity will be ongoing throughout the plan period.

9. External Issues

a. Monitor pesticide residues on incoming tobacco lots, finished products, potential leaf purchases, and potential exports to the USA with a frequency based on legal requirements and sound statistical practices - This activity will be ongoing throughout the plan period. It should be pointed out, however, that the number of analyses are expected to increase significantly during the next three years, and new methods will be developed to handle this increased sample load.

b. Develop rapid screening methods for pesticides which will allow a significant reduction in workload while maintaining a high level of reliability - There are four specific approaches which will be investigated in 1993 all of which utilize some aspect of biotechnology. These approaches are:

(1) Validate commercially available ELISA systems for pesticides (3-6) with respect to applicability to tobacco and reproducibility as a function of blend - 4th quarter, 1993.

(2) Assess the feasibility of using affinity chromatography with antibody columns as a simple purification step for pesticides prior to chemical analysis - 3rd quarter, 1993.

(3) Assess the feasibility of developing antibodies with sufficient cross-reactivity to allow analysis of all organophosphate pesticides - 4th quarter, 1993.

(4) Investigate the use of enzymatic sensors utilizing acetylcholinesterase as a potential method for the analysis of organophosphate pesticides - 3rd quarter, 1993.

c. Monitor ingredient levels in cigarette, packaging, and manufacturing materials either currently being used or being evaluated for qualification - This activity will be ongoing throughout the plan period.

d. Extend analytical capabilities for pesticides and ingredients for which legislation is being proposed or which are considered undesirable in, or in contact with, our products -

(1) Complete the development of a method for MH-30 which will replace the current colorimetric method - 1st quarter, 1993.

(2) Develop a method for acephate - 1st quarter, 1993.

(3) Refine the current methods for ethylene dibromide and dibromochloropropane - 2nd quarter, 1993.

(4) Develop a new method for aldicarb - 3rd quarter, 1993.

(5) Develop a method for flavaspidic acid, a marker compound for use in the flavor monitoring probram in Germany - 4th quarter, 1993.

e. Establish a data base for analytical methods which would ensure that results obtained during any period of time can be related to a specific analytical method - Establish a system similar to that used by QA for pesticide and ingredient analysis including coding of the samples so that the method used can be determined from the sample code - 3rd quarter, 1993.

f. Identify areas of processing which may pose environmental impact problems in the future and provide Process Development support for ECO Audits of existing and new facilities in both PME Regions - At this time it is impossible to list any specific timetable to address this strategy. With respect to the

EEMA Region, R&D will have specific audits to carry out during 1993. Likely sites are Alma Ata, Samara, Krasnodar, and St. Petersburg.

g. Develop a long-term plan for the further reduction of the tar deliveries of our brands so as to comply with the 1998 EEC tar ceiling regulations, including the evaluation of emerging technologies for low tar/high taste - The possibility of standardizing the German and Pan European Marlboro blends and carrying out the required consumer testing will be completed in 1993.

h. Develop, in conjunction with Packaging Engineering, new materials which can be used to meet potential legislation regarding packaging recyclability - A decision has been reached to introduce packaging which is recyclable without the need for any type of separation in Germany by the 3rd quarter of 1993. In support of this activity, R&D will undertake the following activities by the end of the 2nd quarter:

(1) Carry out material trials with new and/or modified materials.

(2) Ensure that there have been no adverse effects on cigarette quality as a consequence of alternate packaging materials.

(3) Study the impact of modified pallet packaging on the quality of deliveries.

(4) Determine the barrier properties of alternate inner wraps.

(5) Ensure that new or modified materials meet governmental regulations with regard to heavy metal content.

(6) Request a qualitative research study to determine consumer preference with respect to environmentally friendly packaging.

i. Contribute, through contact with suppliers and governmental authorities, to the registration of PM recommended infestation control products - Presently this strategy is being addressed through registration support to Zoecon, field trials, lab support, and promotion of the use of methoprene via the infestation industry working group. Should a decision be made in 1993 to use 100% Kabat, additional activities would have to be initiated; namely:

(1) Evaluate current methods and applicator types in collaboration with PM USA.

(2) Establish an information exchange network.

(3) Standardize applicators and application techniques.

(4) Follow up registration efforts world wide.

(5) Monitor the efficiency of methoprene application.

j. Develop, together with suppliers, new adhesives for cigarettes and packaging materials which are based on naturally occurring substances - With respect to tipping and sideseam adhesives, the goal is to have one adhesive completely qualified by the end of 1993. It is planned to standardize packaging adhesives

to the best extent possible, and participate in a synergy effort to reduce the number of suppliers by the 4th quarter of 1993.

k. Develop a battery of analytical tools for emissions and effluents - Support will be provided to the environmental group through the development of appropriate sampling and analytical techniques as well as through the use of computer modelling.

l. Investigate the development of bio-filtration and scrubbing techniques - A plan for this activity will be drafted during the 2nd quarter of 1993.

m. Establish Material Safety Data Sheets for casings and flavors - This activity will be ongoing throughout the plan period.

n. Continue to interact with other PM Europe Companies to ensure harmonization of environmental programs - Continue to participate in existing environmental synergy task forces and initiate the formation of a completely integrated environmental policy within the plan period.

o. Continue to ensure that PM products are properly tested by governmental laboratories, thereby avoiding problems which could prevent the sale of our products in certain markets - Ongoing efforts throughout the plan period will include:

   (1) Maintaining contacts with official laboratories in the UK, France, Belgium, Switzerland, Finland, and Gulf Coast Countries, and developing contacts with Italy, Spain, and Hungary by the end of 1993. Periodic visits will be made to continue these relationships.

   (2) Running collaborative tests, whenever possible, with official laboratories, and/or assisting them in cases of disagreements and or technical problems.

   (3) Support and train, if requested, official laboratory chemists, provide technical assistance, and promote new technology.

p. Identify regulatory issues of corporate concern in the EEC and EEMA Regions, advise management concerning their technical and legal ramifications, and represent the industry's interests through interactive programs with scientific and norm associations - This strategy is being addressed by maintaining an awareness of regulatory issues in conjunction with PME Corporate Affairs and participating in Coresta task forces, such as roll your own, analytical methods, monitor cigarette, nitrogen oxides, pressure drop, and ventilation, as well as groups such as the Swiss Norm Association and the Tobacco Advisory Council (UK).

VII. Resource Allocations

Resource allocations for 1993 are shown in Table VII arranged by both R&D program and R&D department. Because of the size of the Operations Support Program, it has been broken down into its six component sub-programs. Support has been allocated to the appropriate R&D program where possible. Unallocated support is listed in Table VI as support. As would be expected, most of the support function is located within the R&D Services Department.

As can be seen from Table VI, Operations Support is the largest program with a total of 79.6 individuals or 44.0% of the total staff. The second largest program is External Issues with 14.4% of the staff. Product Development has 9.7% of the total personnel, while The Competitive Environment has 6.0%. Unallocated support is 7.7% of the R&D staff, while administration is 8.3%. Administration is composed primarily of the R&D Directors and the secretarial staff.

It is quite clear that there are a number of programs which have relatively few individuals committed to them. It was a joint decision to retain these programs for 1993. However, there may be alternate ways of organizing the programs to combine those which have relatively few allocated resources. This issue must also be considered in light of the current R&D project system which makes allocation of resources below the level of program extremely difficult because of the large number of projects. These issues will be discussed further in the final section.

TABLE VII

PME R&D Resource Allocations for 1993 By Program

R&D Programs	QA	Res.	Prod Devel.	Proc Devel.	R&D Serv.	Total
Operations Support						
- Product Quality	16.3	0	0.2	0	2.6	19.1
- Raw Material Quality	18.5	4.5	0.6	0	3.8	27.4
- Productivity Improvements	4.0	0	2.0	0	1.0	7.0
- QA Standardization	8.8	2.5	0.7	0	2.0	14.0
- Quality Management	4.8	0	0	0	0.8	5.6
- Process Development	0.3	0	0.5	3.9	1.8	6.5
Sub Total	52.7	7.0	4.0	3.9	12.0	79.6
Reconstituted Tobacco	0.4	0	0.1	1.5	0.3	2.3
Expanded Tobacco	0.4	0	0.1	2.5	0.5	3.5
Product Development	4.0	0	11.0	0	2.5	17.5
New Product Technology	0.5	1.5	3.8	0	0.9	6.7
The Competitive Environment	7.5	0.3	1.6	0	1.5	10.9
New Process Technology	0	0	0.5	0.9	0.2	1.6
Environmental Tobacco Smoke	0	3.0	0.7	0	0.6	4.3
External Issues	2.7	17.2	1.2	0	4.5	25.6
Support	2.7	0	0	6.2	5.0	13.9
Administration	5.1	2.0	1.0	2.0	5.0	15.1
Totals	76.0	31.0	24.0	17.0	33.0	181.0

VIII. Internal Issues

A. Introduction

There are a number of internal issues which have surfaced as a consequence of the situational analysis carried out which need to be addressed during the plan period in order to optimize the effectiveness of the R&D function. These issues are: 1) the current R&D project system; 2) future patent policies; 3) consumer testing; 4) the utilization of QA resources in an environment which includes increasing demands but constant head count, 5) collaboration with Science & Technology (S&T) and INBIFO, and 6) interaction with PM Europe Marketing Departments. Each of these will be discussed briefly below.

B. Project System

As was mentioned in the internal analysis, the current project system at R&D has its present form as a consequence of the cost accounting system. At one time, work carried out by R&D was charged back to the requesting entity. Therefore, it was necessary to record the amount of time spent on each request for budgetary reasons. The result was that similar activities would be organized into a large number of projects, since there were multiple requestors for the activity. Every blind product test was given an individual project name. QA work for each factory was divided into multiple projects so that the each factory was identified. The cost accounting system was changed some time ago, and all R&D work is now covered by the R&D budget irrespective of the source of the request. However, the project system remains, and the current project system, with its approximately 350 projects, is not well adapted to planning.

Although the current PME three-year plan is now organized by program as opposed to projects, simply tracking progress and resource allocations by program is also not completely satisfactory. Some of the programs, particularly Operations Support, are extremely large, while others are quite small. The best solution to the problem would be to track strategies; that is, to assign a project to each strategy. This solution was not adopted for the 1993-1995 plan, since it was pointed out that some of the strategies, as currently defined, would have less than 1 person allocated to them. As a consequence, it would have been most difficult to carry out meaningful resource allocations. If, however, this philosophy is adopted for the next three-year plan, than it should be possible to combine similar strategies so that this problem no longer exists. This would have the added benefit of reducing the number of strategies which should simplify both the writing of the plan, and tracking progress during the year.

C. Patent Policies

The PME patent group was moved in 1992 from S&T to R&D. Therefore, R&D now has the responsibility of defining the patent philosophy for Philip Morris Europe. There are two specific questions which need to be answered. The first is, how aggressive should PME be with respect to patenting; and the second is, what should be done with respect to extending existing patents to Eastern European countries? It is outside of the scope of this discussion to definitively answer either of these two questions. However, with respect to the first question, some of our competitors have adopted extremely aggressive patent policies - particularly BAT, consequently, it is to our advantage to do so likewise. In addition, following the restructuring in PM USA, a number of projects have been discontinued in Richmond in order to eliminate overlap between the two R&D labs. Consequently, PM Europe cannot depend on Richmond acting as the central patent group for PM tobacco technology. With respect to the question regarding Eastern bloc countries, one possibility is to file patents there retroactively. This may be the best approach, since we will

be dealing with the same competitors in Eastern Europe that we have been dealing with in the West.

D. Consumer Testing

One of the major R&D accomplishments during 1992 was the establishment of a new type of smoking panel within R&D and the development of R&D driven consumer testing using a monadic type approach identical to that being used in PM USA. The smoking panel at R&D is now completely functional, and panels within our affiliates are now being trained. Monadic consumer testing will be initiated in early 1993. This technique is not only state-of-the-art, but has been well established in Richmond as an excellent tool for determining consumer acceptance of either a new product or a product which incorporates a processing change. Monadic consumer testing will not achieve its maximum potential, however, if an expert panel within PM Europe acts as an independent judging and calls into question the results of consumer testing. This plan strongly recommends that the function of Panel A be changed to match the function of the Richmond Panel in the US. In the US all cigarettes are smoked by the Richmond Panel before being submitted for monadic consumer testing. The purpose of this smoking is not to determine if two cigarettes are different, or if one is better than the other, but rather to ensure that nothing has gone wrong in the manufacture of the prototypes. There is little point in submitting prototypes for consumer testing, if there was a problem when they were being made.

It should be strongly emphasized that this recommendation is not made because of a belief that Panel A is not competent to make judgments regarding cigarettes. Instead, the reason for this recommendation rests on statistical grounds. It has been well established that cigarette-to-cigarette variation is considerable. It is not at all unlikely that the difference between two "identical controls" is actually greater than the difference between a given control and a given test cigarette. Therefore, when a small panel is evaluating a limited number of cigarettes, its judgment is much more biased due to cigarette-to-cigarette variability compared to a large number of consumers evaluating a large number of cigarettes. Secondly, just as with foods, different individuals perceive cigarettes differently. Again, this individual bias is much more likely to affect the conclusions of a panel as opposed to a monadic consumer test. Both of these points have been well established quantitatively, and, as a consequence, all decisions regarding differences between a control and a test cigarette should be made only by consumer testing.

E. QA Resources

It is an inescapable conclusion that both the number of PME affiliates and the total number of brands will increase during the plan period and beyond. This increase will place additional demands on QA manpower which cannot be satisfied by simply adding more people. Consequently, QA must carry out a number of studies to ensure that all the work they undertake truly contributes to improving some aspect of quality. To ensure that this is done, it is helpful to adapt the following paradigm for QA; namely, that every QA activity should contribute to: 1) maintaining or improving the quality of the final product as perceived by the consumer; 2) ensuring that products meet regulatory requirements; and 3) reducing the number of rejects during the manufacturing process, thereby improving factory productivity.

To ensure that these goals are met with optimum efficiency, there are a number of basic studies which need to be carried out, and which should be carried out during the plan period. These studies are listed below.

1. What does quality mean to the consumer?

   Cigarette quality is generally determined by a group of individuals within the cigarette company. The consumer may, or may not, be concerned about the same quality parameters. The use of customer complaints to determine those aspects of cigarette quality which are important may be a slight improvement, but it is still not the best system, since customers often may not complain about anything but the most major of problems. In many cases, they may simply switch brands and not bother communicating with the manufacturer. A study on this very subject is in progress in Richmond, and should be complete by the end of 1992. Since consumers in the USA may not be identical in attitudes to those in Europe, it may not be possible to simply adopt the conclusions of this study without doing further work. However, the conclusions of this study should be at least suggestive in pointing out if changes may need to be made in how we judge cigarette quality, and the methodology of the study can probably be adopted with little or no change.

2. How can compliance with regulatory requirements be simplified?

   From a manufacturing standpoint, the major regulatory requirement of concern is tar delivery. The tar delivery of a cigarette is a consequence of a number of factors including amount of tobacco, tobacco blend including percentage of ET, paper porosity and composition, tipping paper ventilation, and filter composition. Each of these variables is controlled as well as possible; however, what has not been done in the past is to determine if there are regions for each of these components where variability is much less important with respect to tar delivery as compared to other regions. For example, it has been determined that if a paper is specified with a Coresta porosity of about 50 and a calcium carbonate level of about 33%, than a 10% deviation for either of these two variables has almost no effect on tar delivery. However, at a porosity of 20 Coresta and a calcium carbonate level of 26%, 10% deviations have significant effects on delivery. It should, therefore, be a long term goal of setting specifications to choose ranges, if possible, where effects of variations on delivery is small. In this way, raw material variability plays a much smaller role on tar delivery, and monitoring of raw materials becomes much simpler.

3. What factors are responsible for rejects during the manufacturing process?

   Theoretically, if both process and raw material quality are controlled, rejects during the manufacturing process should be eliminated. Consequently, it is essential to determine what the causes are for factory rejects, and to prioritize these causes. Some of this information is surely known, but it does not seem to be widely available. In order to be able to quantitate the "cost of non-quality," however, this information is essential. Once this question has been answered, it becomes relatively easy to determine the return on investment for a given quality procedure. It should be noted that there is one other question which must be raised, once it has been decided that a given type of quality improvement will have a real impact on factory productivity; namely, can a method be developed to install an on-line monitor for the given type of improvement?

F. Collaboration with S&T and INBIFO

For several years the point has been made in the PM USA R&D Five-Year Plan that the number one issue facing PM USA is ETS. This prediction appears, unfortunately, to be borne out

by recent results. ETS has not been a major factor in Europe; however, that is changing. The Loi Evin in France is one piece of evidence, but there are many others as well. It is true that the problem may never become as significant in Europe as it is in the US, but there is no question that it will be a major problem. Both S&T and INBIFO have been charged with investigating scientific approaches that would provide evidence demonstrating that our critics are severely misguided with respect to ETS. PM Europe R&D also has an ETS program. It is essential to optimize our contributions to the ETS effort within PM Europe by working closely with both S&T and INBIFO in this area.

G. Interaction with Marketing

The last issue, interaction with Marketing, requires that during the plan period R&D and Marketing work together quite closely. There are two reasons for this recommendation. The first is that it may take considerable development time to optimize a new product, and if R&D simply waits until Marketing requests a new product, that development time may not be available given the requested time schedule. What may happen is that a sub-optimum product is introduced, so that Marketing's schedule is not disrupted. Secondly, Marketing and R&D both have unique expertise with respect to new products. Under the current working arrangement, not enough of R&D's expertise is being used. It has been the goal of the Product Development portion of this plan to set up methods whereby R&D can proactively develop new products even in the absence of a fully developed interaction with Marketing. This represents a significant improvement on an approach which is not proactive at all, but is still inferior to an arrangement wherein Marketing and R&D are equal partners.